REMARKS/ARGUMENTS

Claims 1, 2, 9 and 10 remain pending herein. Claims 3 and 4 have been cancelled without prejudice or disclaimer.

Claims 3 and 4 were objected to under 37 C.F.R. 1.75(c). As noted above, claims 3 and 4 are cancelled hereby, rendering this objection moot. It is respectfully requested that the U.S. Patent and Trademark Office reconsider and withdraw this objection.

Claim 1-4, 9 and 10 were rejected under 35 U.S.C. 102(a) over Japanese 11-135152 (JP '152).

The present invention is directed to a lithium secondary battery comprising an electrode body including a positive electrode, a negative electrode and a separator, and a non-aqueous electrolytic solution. The positive electrode comprises lithium manganese oxide of cubic system spinel structure as the positive electrode active material. The negative electrode comprises graphitized carbon powder as the negative electrode active material. After 20,000 cycles, the battery according to the present invention contains water and hydrofluoric acid in a total concentration of 10,000 ppm or less.

JP '152 is directed to a non-aqueous electrolyte secondary battery formed by pouring a non-aqueous electrolyte containing a lithium salt in a battery container, and then sealing the battery container. According to JP '152, the content of free acid contained in the non-aqueous electrolyte is controlled so as to not exceed 300 ppm three years after sealing. JP '152 discloses that it is desirable that the moisture content which the electrode group, before inserting in a cell can, contains is 300 ppm or less.

JP '152 fails to disclose or suggest any test results which occur *after cycling* a battery according to JP '152, nor does JP '152 contain any disclosure regarding concentration of

water, concentration of hydrofluoric acid or combined concentration of water and hydrofluoric acid *after cycling*. In addition, JP '152 fails to contain any disclosure of hydrofluoric acid concentration in an entire battery according to JP '152 (JP '152 discloses only free acid concentration *in the electrolyte* of the batteries according to JP '152). Furthermore, JP '152 fails to disclose water concentration in an entire battery according to JP '152 (JP '152 discloses water concentration *in the electrode group* of the battery according to JP '152).

In order to sustain a rejection under 35 U.S.C. §102, it is necessary for the prior art reference to expressly or inherently describe each limitation set forth in the claim being rejected. As detailed above, JP '152 fails to disclose several limitations recited in claim 1, and fails to disclose any battery which inherently satisfies all of the limitations recited in claim 1. Accordingly, it is respectfully submitted that the rejection under 35 U.S.C. §102 is improper and should be withdrawn.

Accordingly, it is respectfully requested that the U.S. PTO reconsider and withdraw this rejection.

Claims 1-4, 9 and 10 were rejected under 35 U.S.C.§103(a) over Japanese 10-116631 (JP '631) in view of JP '152, U.S. Patent No. 5,807,646 (Iwata '646) and U.S. Patent No. 5,792,577 (Ejiri '577).

JP '631 discloses a non-aqueous electrolyte secondary battery in which the moisture content of the entire cell is 2,000 ppm or less. The Office Action contains a statement that JP '631 discloses that the electrolytic solution employed therein contains water and HF in a total maximum concentration of 150 ppm or less.

The Office Action contains an assertion that the cell according to JP '631 would have a combined water and HF content of less than 10,000 ppm after 20,000 cycles. There is no basis in JP '631 (or any other reference) for this assertion. JP '631 contains no disclosure of water content, HF content or combined water and HF content in a battery *after any cycling*, let alone after 20,000 cycles. In addition, JP '631 contains no disclosure of HF concentration of an *entire cell* (the only disclosure in JP '631 regarding HF concentration relates to HF concentration *in the electrolytic solution*).

During the course of charging and discharging cycles, the temperature of a battery including a lithium secondary battery is typically raised due to Joule heat created by internal resistance within the battery, and such internal resistance typically increases with repeated charging and discharging cycles. Due to the temperature rise of the battery, the rate of the chemical reaction I set forth below increases and results in increasing generation of HF.

I $C_2H_5OCOOC_2H_5 + PF_6 = C_2H_5OCOOPF_4 + HF + C_2H_4$

The compound $C_2H_5OCOOC_2H_5$, carbonic acid aster, is present as the solvent of the non-aqueous electrolytic solution used according to the present invention. The compound PF_5 results from decomposition of $LiPF_6$ contained in the electrolyte.

Accordingly, because HF is created during use of a battery, persons of ordinary skill in the art would have no idea how much HF would be present within the cell according to JP '631 after 20,000 cycles based simply on disclosure in JP '631 of initial control of HF during manufacture. Neither JP '631 nor any of the other applied references contain any suggestion that the amount of water and HF in the entire cell *after cycling* is critical to control in order to obtain longer battery life.

In tests reported in the present specification, tests according to the present invention were carried out in which the combined water and HF concentration after 20,000 cycles was 398 ppm (Example 1), 1701 ppm (Example 2) and 8817 ppm (Example 3). In addition, Comparative Examples were conducted in which the combined water and HF concentration after 20,000 cycles was 10,230 ppm (Comparative Example 1) and 16,060 ppm (Comparative Example 2). As shown in Fig. 3, the discharge relative capacity of the battery according to Comparative Example 1 was considerably lower than that of the batteries according to Examples 1-3 after 20,000 cycles. The discharge relative capacity of the battery according to Comparative Example 2 was well below that of the batteries according to Examples 1-3 after 5,000 cycles and continued to decrease much more rapidly than that of Examples 1-3 as the number of cycles went up to 20,000.

The Office Action refers to no disclosure in JP '152, Iwata '646 or Ejiri '577 which would overcome the shortcomings of JP '631 as attempted to be applied against claim 1, as discussed above.

In view of the above, it is respectfully requested that the U.S. PTO reconsider and withdraw this rejection.

Claims 1-4, 9 and 10 were provisionally rejected over claims 1-8 and 12 of copending application No. 09/770,725 in view of JP '631, German 198 27 631 (DE '631) or WO 99/34471 (WO '471). In view of the provisional nature of this rejection, the Applicants wish to defer consideration of this rejection.

In view of the above, claims 1, 2, 9 and 10 are in condition for allowance, subject to the provisional obviousness-type double patenting rejection.

If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicants' attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,

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